Consommation et Affaires commerciales Canada
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Bureau des brevets
Patent Office

Ottawa, Canada
K1A 0C9

(21) (A1) 2,086,445

(22) 1992/12/30

(43) 1994/07/01

5,087,759

(51) INTL.CL.[5] A47L-005/00

(19)(CA) **APPLICATION FOR CANADIAN PATENT** (12)

(54) Miniature Vacuum Cleaning System

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(73) Same as inventor

(57) 20 Claims

ABSTRACT OF THE DISCLOSURE

A miniature vacuum system includes a plurality of separate probes which can be attached to a support head and manipulated in the manner of a writing implement. Some of the probes are formed simply from a tube with a resilient coating at the end of the tube for engaging the surface. Other probes have a sweeping surface on which is attached a loop pile fabric. The head is attached to a half inch diameter hose with a number of different adapter heads being available for coupling the hose to an existing vacuum system. Two of the heads are used with different types of rechargeable portable vacuums.

MINIATURE VACUUM CLEANING SYSTEM

Many industries and endeavors such as photography, electronics and similar items have problems with dust and other debris which must be removed from the area to prevent contamination.

In the photography industry, photographers often purchase compressed air which is used to blow the dust and other particles away from the instruments to prevent them from intering with the photographic process and providing contamination of the final product. However of course the simple propelling of the dust or other particles away from the area acts to render these particles airborne so they again fall back onto surfaces, in many cases coming back to the area to contaminate the next process.

Vacuum cleaners are of course readily available for cleaning various areas and in recent years portable vacuum cleaners have become popular of a type which are of relatively low power but which are normally suspended on a support for recharge of a battery within the vacuum cleaner body itself. These vacuum cleaners are therefore very portable as they do not require a mains connection cable but the suction nozzle is relatively large and very crude and hence is unsuitable to act as a probe in relatively small areas.

It is one object of the present invention, therefore, to provide a miniature vacuum cleaning system which allows suction to be communicated by a relatively small probe into an area for cleaning of that area.

It is a further object of the present invention to provide a plurality of

different probe arrangements which are useful for different operations in cleaning an area of this type.

It is a yet further object of the present invention to provide a system of attachment of the various elements to an existing portable vacuum cleaner.

According to the invention, therefore, there is provided a miniature vacuum cleaning apparatus comprising a flexible hose having a diameter less than one inch, a connector head arranged for substantially sealing attachment to one end of the hose, a plurality of probe elements each arranged for separate attachment to the connector head and an adapter head for attachment to a suction source defined by a separate vacuum cleaner, the adapter head having a first connector piece arranged for substantially sealed attachment to the hose and a second connector piece of different transverse dimensions from the first connector piece arranged for attachment to a suction outlet of the separate vacuum cleaner.

One embodiment of the invention will now be described in conjunction with the accompanying drawings in which:

Figure 1 is a schematic illustration showing the various different elements of the system.

Figure 2 is a vertical cross section view through and end of the hose, the connector head and one probe from the system of Figure 1.

Figure 3 is a similar vertical cross sectional view through the connector head and a second probe of Figure 1.

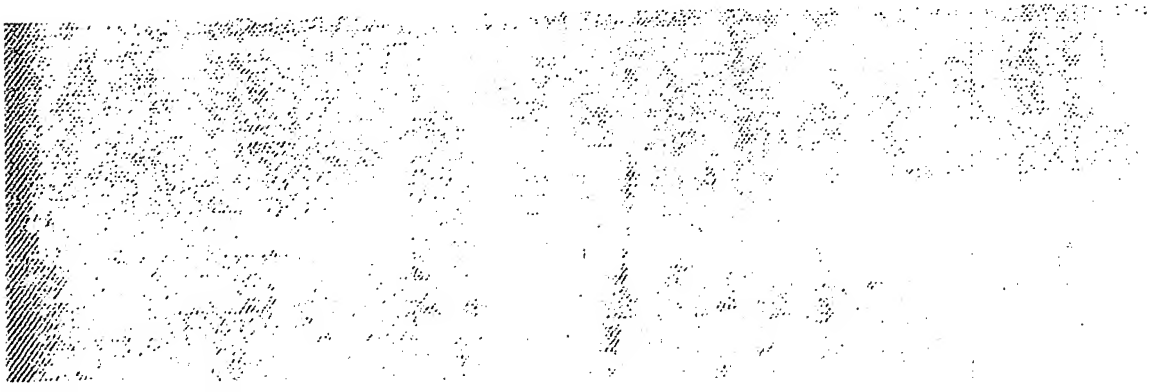

Figure 4 is a vertical cross sectional view through the outer end of one of the probes of Figure 1.

Figure 5 is an isometric view of the end of the probe of Figure 4.

Figure 6 is a vertical cross sectional view through a further one of the probes of Figure 1.

Figure 7 is a vertical cross sectional view through a nozzle of a portable vacuum cleaner showing the connection of one of the connector elements of Figure 1 to the nozzle of the portable vacuum cleaner.

Figure 8 is a front elevational view of the connector of Figure 7.

Figure 9 is a front elevational view of a portable vacuum cleaner mounted in a support bracket therefor with the barrel and nozzle section removed and replaced by the connector from the system of Figure 1.

Figure 10 is a cross sectional view along the lines 10-10 of Figure 9.

In the drawings like characters of reference indicate corresponding parts in the different figures.

The various elements of the system are shown in Figure 1 and include a plurality of elongate vacuum cleaning probes indicated respectively a 10, 11, 12, 13 and 14. In addition the system includes a surface vacuum head 15. All of the probes and

the head 15 are arranged for attachment to a connector head 16 which in turn can be connected to a flexible hose 17 for drawing air into the probes through the hose to a vacuum source.

For connection to the outer end of the hose are provided adapter heads 18, 19 and 20 each of which is arranged for connection to a vacuum source as described hereinafter.

The system therefore described above can be supplied as a kit of parts which allows the user to select from the various probes and from the various adapter heads for attachment to an existing vacuum source to allow that vacuum source to be communicated delicately by the selected probe to a relatively small location for high efficiency cleaning.

Turning now to Figure 2, the probe 13 is shown attached to the connector head 16 which is in turn attached to the hose 17. Thus the connector head 16 includes a cylindrical portion 21 which receives an end of the hose attached thereto as a friction fit. A main body of the connector head 16 includes a plurality of ridges or knurls 22 to allow ready manual grasping of the head in the manner of a pencil so that the probe 13 can be carefully pointed by manual control to move the outer end 23 of the probe into the required position. The connector head 16 has a bore 24 extending therethrough with a counterbore portion 25 of slightly increased diameter to receive the outer surface of the probe 13 as a sliding fit therein. The inside surface of the probe 13 therefore follows substantially smoothly through the bore 24 and into the interior of the hose 17. The diameter of the hose 17 is less than one inch and preferably of the order of 0.5 inch which provides a relatively small

communication which can be handled simply by the manual grasping of the head 16 since the hose is relatively light in weight and has little resistance to movement.

The probe 13 is formed of a rigid plastics tube which thus has a diameter of the of 0.5 inch. A separate O ring 26 applies a friction fit on the outside surface of the probe 13 and it is normally maintained at a position adjacent the inner end of the probe so that it engages the end face of the head 16 when the probe slides into place within the counterbore 25.

The probe 13 at the end 23 has an end face cut at an angle of 45° to the longitudinal axis of the cylindrical tube forming the probe. The end face is thus formed simply as an end of the tube having a thickness equal to the thickness of the tube. The tube is formed from a rigid material so that it remains straight and elongate when used as a probe.

In figures 4 and 5 are shown the end of the probe 14 which is the same as the probe 13 in all respects except at the end 27 thereof. In this arrangement the end 27 is cut in two planes 28 and 29 each at 45° to the longitudinal axis. Each cut end thus diverges outwardly from an end diameter 30 outwardly toward the head 16. This arrangement allows one side of the V shaped opening thus defined to rest on a horizontal surface thus substantially closing off that half of the opening while the remaining half of the opening as shown in Figure 5 extends upwardly in an arch to allow air to flow into that part of the opening and into the tube.

Both of the ends 23 and 27 include a resilient coating on the tube. The coating material is indicated at 31 and is shown in best detail in Figure 4 where the coating material 31 engages and surrounds the outside surface of the tube 14 and

also provides a layer 32 on the inside surface of the tube 14. The layer also includes an end face portion 33 which lies on the end face of the tube. Thus all parts of the tube which will engage the surface to be probed are covered with the resilient or rubber layer to provide protection to that layer and prevent scratching of delicate material such a photographic coating.

Turning now to Figure 3, the probe 10 is shown attached to the head 16. The probe 10 comprises a flexible tube 34 of a plastics material and of a diameter approximately one half of that of the tube 13. In the practical example, therefore, the diameter of the flexible tube 34 is of the order of one quarter inch and this approximates to the diameter of a drinking straw. The stiff and self supporting plastics material or drinking straw which also will flex if necessary can be used as the tube 34. The tube 34 is applied over the surface of a rigid rigid tube portion 35 as a friction fit. The rigid tube portion 35 projects outwardly from the end of the tube 34 and can be inserted into a bore 35A of a coupling head portion 36 engageable as a friction fit over the tapered front surface of the head 16. The portion 36 thus acts as an adapter in that it defines the bore 35 which is of reduced diameter relative to the bore 25. An O-ring 35B is provided on the tube portion 35 for sealing purposes. In the example shown this is provided by an inside surface of the portion 36 engaging over the outside surface of the head 16. However in an alternative arrangement the connecting portion receiving the probes 10, 11 and 12 can act as an insert to the bore 25. The rigid tube portion 35 is identical to the similar tube portions 35 used in the probes 11 and 12. The difference between the probes 10 and 11 is that the probe 11 includes an accordion section 38 conventional in a drinking straw which allows the probe to bend to a required angle as illustrated.

The probe 12 is mounted on the rigid tube portion 35 as previously described and attached into the head portion 36. The probe 12 however includes a rectangular molded plastics body mounted on the rigid tube portion 35. The rectangular body is again elongate and includes a rectangular end face 40 as best shown in Figure 6. The end face 40 has an opening 41 communicating with the bore 42 along the inside of the probe 12 which again communicates with the rigid tube portion 35. The end face is arranged at an angle of 45° so that when the head 16 is grasped in the manner of a writing implement the end surface 40 is positioned at an angle to lie horizontal surface to wipe across that surface. Around the opening 41 is attached a fabric layer 43 which covers the end face 40 except at the opening 41. The fabric 43 is of the loop type used in a hook and loop fastener fabric construction so that the fabric 43 includes a plurality of looped fibers 44 projecting outwardly from the fabric 43. The fabric is adhesively attached to the end face. The loop fibers 44 thus provide a mat or layer on the end of the probe which can be wiped across a surface in a cleaning action. This is of course similar to the conventional operation of a vacuum cleaner except that the loop fabric including the looped fibers is particularly advantageous in that it dows not in any way shed materials, in that effectively carries the dust particles so that they can be drawn into the opening 41 and removed. It has been found that conventional materials tend to sweep the dust simply from one place to another whereas surprisingly the loop fibers of this type allow the dust to be drawn away and extracted rather than moved about on the surface.

The surface head 15 of the system as shown in Figure 1 includes a flat sweeping surface 45 including a plurality of openings 46 into which air can be drawn from the suction connection to the head 16. The sweeping head 15 includes a cylindrical

projection 47 which engages into the bore 25 or the head 16. On the surface 45 is applied a layer of the fabric 43 including the looped fibers 44. This layer covers the whole of the flat surface 45 except a the openings 46. This head therefore can be used in the manner of a conventional sweeping head of a vacuum in that the head is swept across a smooth surface. Again the looped fibers of the loop fabric effect a surprising action upon the dust particles in that these are removed rather than simply moved from place to place.

Turning now to the adapter heads which allow the system to be connected to a vacuum source, a first of the adapter heads is indicated at 18 and is shown in Figures 1 and 7. This adapter head comprises a flexible rubber cup having a cylindrical wall portion 50 and an end eall 51. The end wall 51 has an opening into which is inserted a connector sleeve 52 which engages into the end of the hose 17. This allows the hose to be sealingly connected to the cup 50 with the sleeve 52 having a head 53 engaging on the inside surface of the base 51. The peripheral wall 50 the cup 18 can be engaged over an open end of a conventional vacuum hose and hense has a diameter of the order of 1.25 inches to receive the end of the conventional hose as a friction fit therein.

The cup 18 thus can act as a first type of connector to a hose of a conventional vacuum cleaner. The adapter heads 19 and 20 are arranged for use with a portable type of vacuum cleaner of the rechargeable type. In Figures 7 and 8 the adapter head 19 is shown in more detail. In Figure 7 the adapter head 19 is arranged in engagement with a nozzle 55 of a portable vacuum cleaner of the type shown under the trademark "Power Pro". This type of rechargeable vacuum includes a lowermost nozzle 56 into which dust and debris is normally drawn into the barrel of the vacuum. The adapter head 19 includes an insert portion 57 which is generally

rectangular in end elevation including a pair of generally parallel sides 58 and 59 and end faces 60 and 61. This projection is thus shaped to insert into the slot shaped opening 56 of the nozzle of the vacuum. The side wall 60 and 61 each include a V shaped recess 62 at the outer end thereof connecting to the sides 58 and 59. This allows some flexibility of the outermost edges of the sides 58 and 59 so as to be squeezed between the end walls of the opening 56 of the nozzle.

Behind the projecting portion 57 is provided an end plate 63 which generally transverse to the longitudinal axis of the projecting portion 57. However the plate 63 is arranged at a slight angle to this longitudinal axis so as to engage over and close the inclined end face of the nozzle. Attached to the rear face of the plate 63 is provided a cylindrical sleeve 64 which projects outwardly therefrom and can receive the cup 18 thereover as a friction fit.

As shown in Figure 7, therefore, the head 18 and the head 19 are used in conjunction to attach to the nozzle of the Power Pro (trademark) type vacuum device. In this arrangement as the nozzle is exposed when the vacuum is supported in the mounting and recharging bracket, the adapter heads can be attached in place while the vacuum is in the mounting bracket. Thus a vacuum device of this type can be mounted on the wall adjacent the work station and the hose extend from the vacuum cleaner to the work station for use of the various probes as previously described.

Turning now to Figures 9 and 10 there is shown in Figure 9 a rechargeable type vacuum cleaner of the type sold under the trademark "Dustbuster". This rechargeable vacuum cleaner is not shown in detail as it is well known to one skilled in the art. The vacuum cleaner includes a mounting and recharging bracket 70

to which is attached a vacuum body 71 including a handle 72 and a battery and motor section 73. A switch 74 can ve actuated to drive the suction motor to draw air through an end face 75 and to expel that air through side vents 76. The vacuum normally includes a vacuum barrel which is mounted on an end portion 77 projecting outwardly beyond the motor portion 73. In the "Dustbuster" (trademark) arrangement, the end nozzle when supported in the mounting 70 is received within a cup 78 and thus is not accessible for a coupling of the type shown in Figure 7. In this arrangement, therefore, the barrel and nozzle are removed and the head 20 is used for direct attachment to the barrel mounting section 77. The clip is shown in Figures 9 and 10 and comprises a flat base plate 78 having a hole 79 through which is attached a sleeve 80 for receiving the hose as a friction fit thereon. The base plate 78 includes a pair of opposed clip legs 81 and 82 which extend upwardly from the plane of the plate 78 at each end of the plate for extending along the sides of the portion 77 of the vacuum and acting as a spring clip arrangement for engaging the sides and holding the plate in engagement with the front face 75 by the friction effect of the spring clip legs. As shown in Figure 10 the width of the spring clip legs is reduced relative to the width of the plate.

On the front face of the base plate 78 is applied a resilient layer 83 of a foam rubber or the like to engage the plate 75 and to act as a seal therewith. Around the hole 79 on the front face of the resilient layer 83 is provided a patch of a hook fabric 84 of the type used in a hook and loop coupling. The hook fabric includes a plurality of hooks 85 of a flexible plastics material which can engage with the fibers of a fibrous filter pad 86 attached to the hooks. The filter pad engages over a hole in the front face 75 through which the air is drawn by the motor in the conventional manner. The clip arrangement therefore acts to directly attach the miniature vacuum system to the permanently mounted vacuum head and

provides a filter for extraction of dust and the like. It is not of course intended to collect large quantities of debris.

Since various modifications can be made in the invention as herein above described, and many apparently widely different embodiments of same made within the spirit and scope of the claims without departing from such spirit and scope, it is intended that all matter contained in the accompanying specification shall be interpreted as illustrative only and not in a limiting sense.

THE EMBODIMENTS OF THE INVENTION IN WHICH AN ESCLUSIVE PROPERTY OR PRIVILEGE IS CLAIMED ARE DEFINED AS FOLLOWS:

1. A miniature vacuum cleaning apparatus comprising a flexible hose having a diameter less than one inch, a connector head arranged for substantially sealing attachment to one end of the hose, a plurality of probe elements each arranged for separate attachment to the connector head and an adapter head for attachment to a suction source defined by a separate vacuum cleaner, the adapter head having a first connector piece arranged for substantially sealed attachment to the hose and a second connector piece of different transverse dimensions from the first connector piece arranged for attachment to a suction outlet of the separate vacuum cleaner.

2. The apparatus according to Claim 1 wherein the hose has a diameter of the order of 0.5 inch.

3. The apparatus according to Claim 1 wherein the second connector piece of the adapter head comprises a projecting portion for engaging into a suction outlet nozzle of a portable vacuum cleaner, the projecting portion having a cross section which is elongate in a transverse direction so as to engage into a slot shaped nozzle of the portable vacuum cleaner.

4. The apparatus according to Claim 3 including a transverse plate on the projecting portion arranged at an angle to a longitudinal axis of the projecting portion so as to engage an end face of the nozzle of the portable vacuum cleaner.

5. The apparatus according to Claim 3 wherein the projecting portion includes a pair of V shaped notches at each end thereof.

6. The apparatus according to Claim 1 wherein the second connector piece of the adapter head includes a pair of opposed clip members at respective ends of a transverse plate member such that a front face of the plate member can engage an end face of a suction portion of a portable vacuum cleaner with the clip members engaging sides of the portable vacuum cleaner to hold the plate in engagement with the end face.

7. The apparatus according to Claim 6 including a resilient layer on the front face of the plate.

8. The apparatus according to Claim 6 wherein the plate has a hole therethrough and in which there is provided a filter pad engaged over the hole on the front face of the plate.

9. The apparatus according to Claim 8 including a hook fabric attached to the front face of the plate, the hook fabric having a plurality of hooks for engaging fibers of a fibrous filter pad for attachment of the pad to the plate.

10. The apparatus according to Claim 1 wherein one of the probe elements includes an end face with an opening in the end face through which air is drawn into the hose, the end face surrounding the opening having a covering layer thereon of a fabric material having a plurality of fiber loops projecting outwardly therefrom.

11. The apparatus according to Claim 1 wherein one of the probe elements comprises a cylindrical tube defining an open end presented outwardly from the connector head for engagement with the surface for suction of material from the surface, the end of the tube being coated with a resilient coating layer surrounding the outer surface of the tube, an inner surface of the tube and the end face of the tube.

12. The apparatus according to Claim 1 wherein one of the probe elements comprises an elongate tube having an end of the tube presented outwardly from the connector head, the end of the tube being shaped to form two end faces intersecting on a diameter of the tube and diverging from the diameter outwardly and toward the connector head.

14. The apparatus according to Claim 1 wherein the plurality of probe elements includes a first probe tube of a diameter substantially equal to that of the hose and a second probe tube of a diameter smaller than that of the first probe tube.

15. The apparatus according to Claim 14 wherein the diameter of the second probe tube is of the order of one quarter inch.

16. The apparatus according to Claim 1 wherein one of the probe elements comprises a rigid insert tube insertable into an opening in the connector head and a flexible plastics head and a flexible plastics tube engaged on one end of the insert tube.

17. The apparatus according to Claim 16 wherein the flexible plastics tube comprises

a tube of the type used as a drinking straw having a diameter of the order of one quarter inch.

18. A miniature vacuum cleaning apparatus comprising a flexible hose, a connector head arranged for substantially sealing attachment to one end of the hose, a probe element mounted on the connector head and an adapter head for attachment to a suction source defined by a separate vacuum cleaner, the probe element including an end face with an opening in the end face through which air is drawn into the hose, the end face surrounding the opening having a covering layer thereon of a fabric material having a plurality of fiber loops projecting outwardly therefrom.

19. A miniature vacuum cleaning apparatus comprising a flexible hose, a connector head arranged for substantially sealing attachment to one end of the hose, a probe element mounted on the connector head and an adapter head for attachment to a suction source defined by a separate vacuum cleaner, the probe elements comprising an elongate tube having an end of the tube presented outwardly from the connector head, the end of the tube being shaped to form two end faces intersecting on a diameter of the tube and diverging from the diameter outwardly and toward the connector head.

20. The apparatus according to Claim 19 wherein the probe element comprises a cylindrical tube defining an open end presented outwardly from the connector head for engagement with the surface for suction of material from the surface, the end of the tube being coated with a relilient coating layer surrounding the outer surface of the tube, an inner surface of the tube and the end face of the tube.

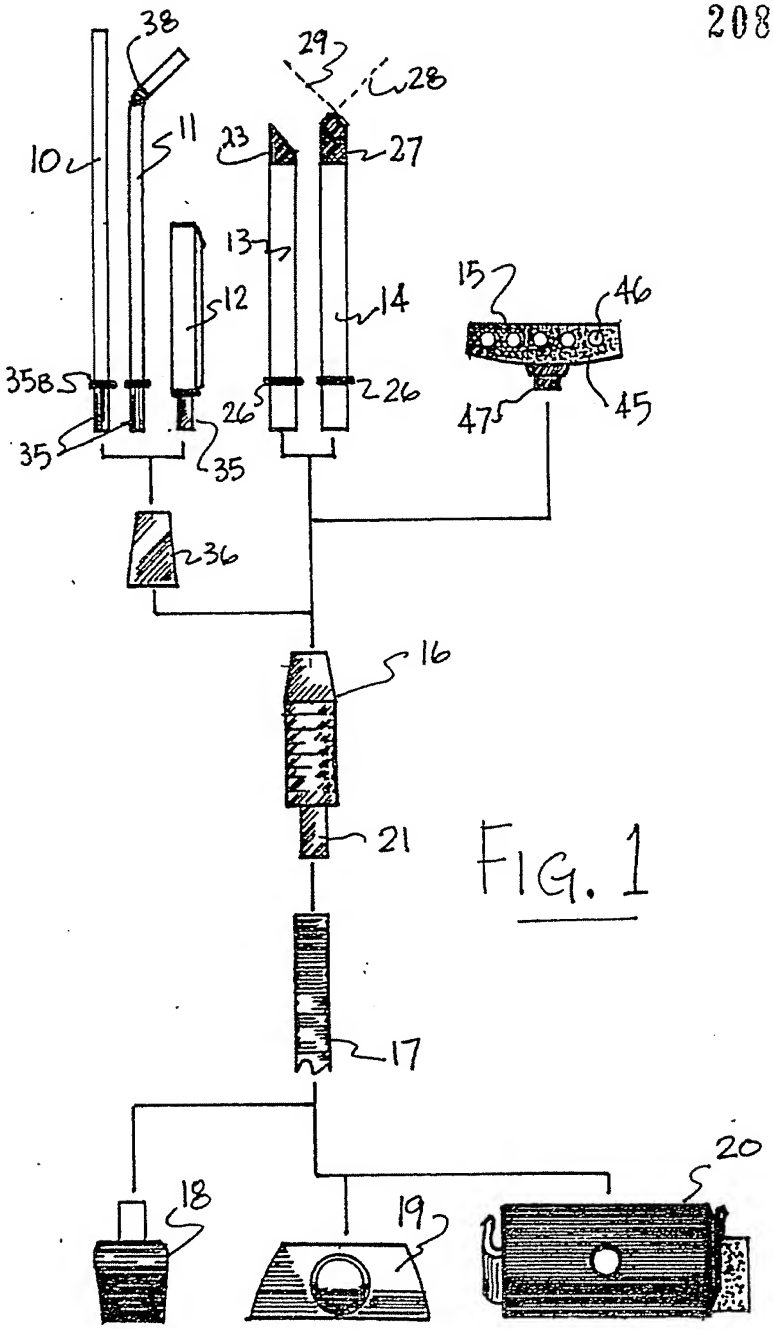
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FIG. 1

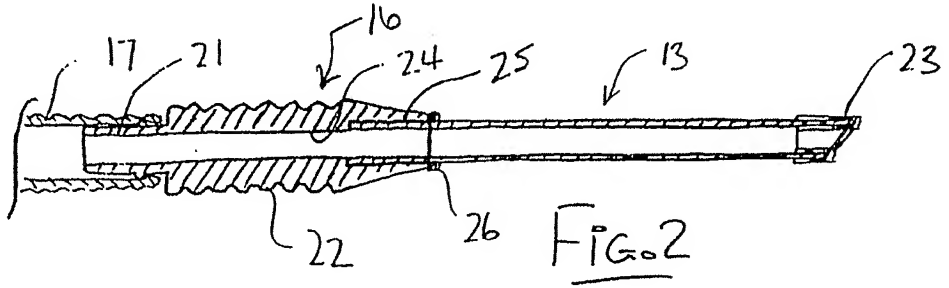


FIG. 2

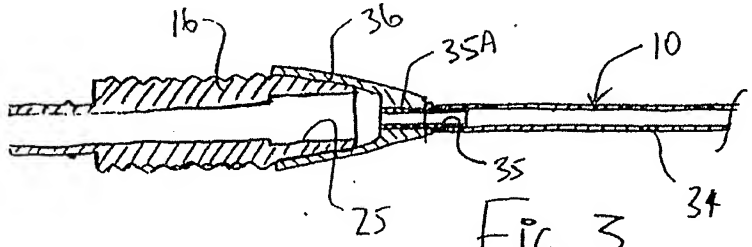
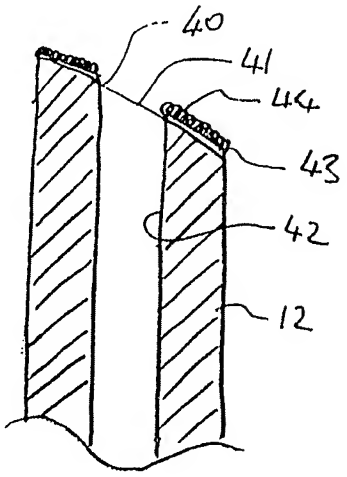


FIG. 3



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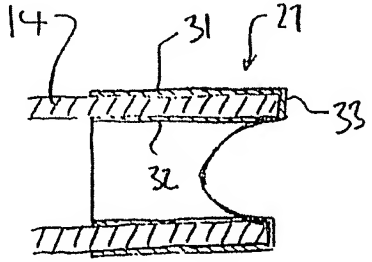

FIG. 4

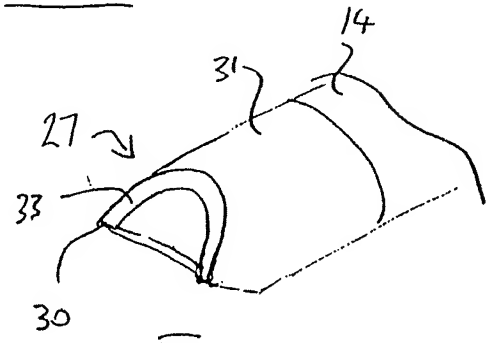

FIG. 5

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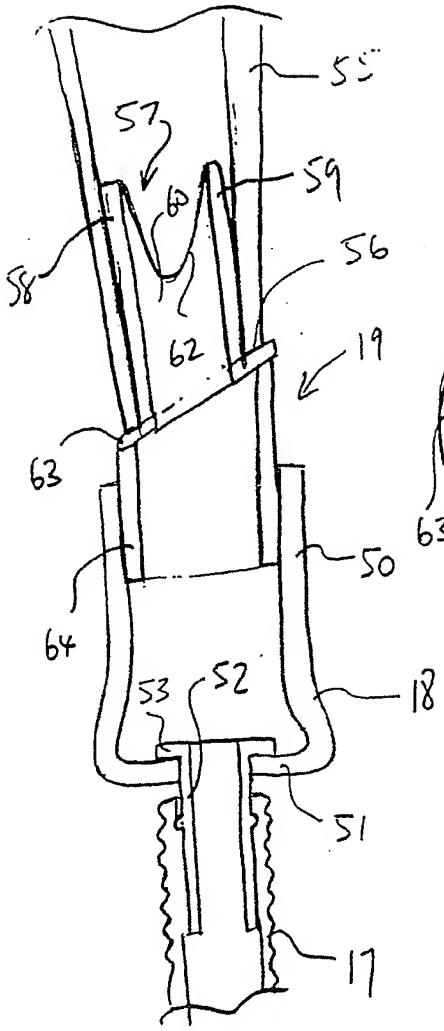

Fig. 7

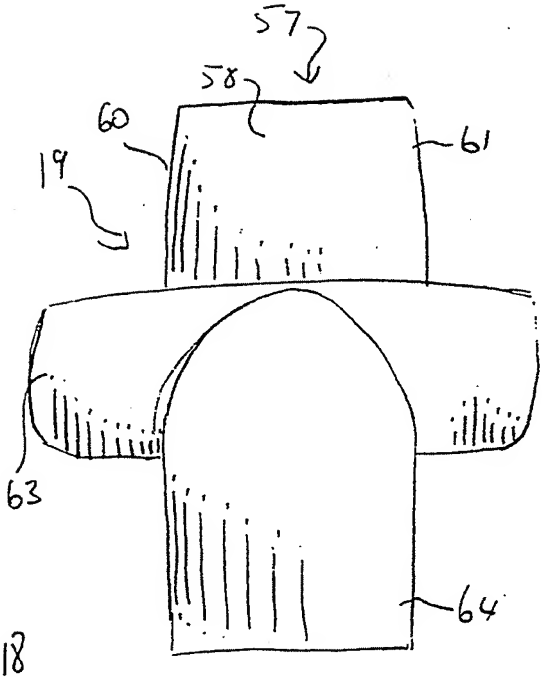

Fig. 8

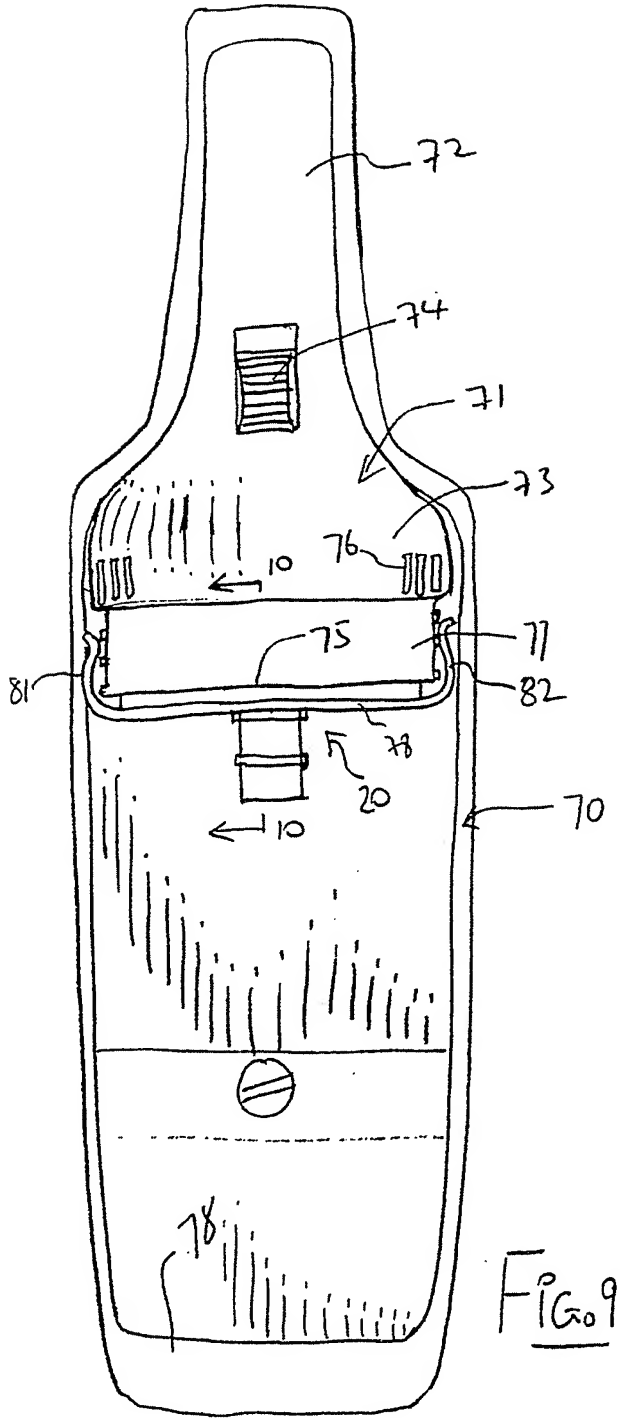

Fig. 9

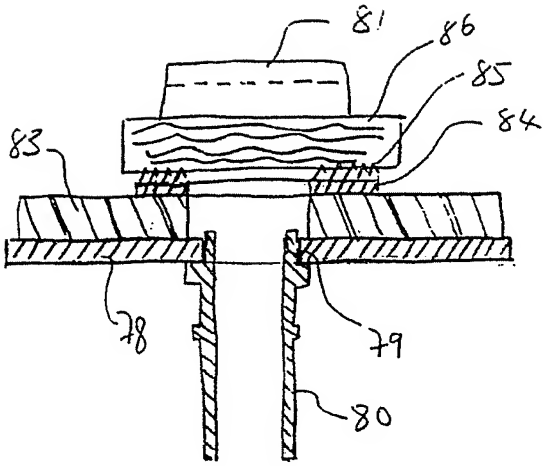

Fig. 10